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FIGURES

1 INTRODUCTION

Once a relatively rare event, the introduction of new area codes is increasing at a previously unheard-of pace. While less than 15 new area codes were introduced in the US between 1961, when nationwide implementation of direct distance dialing (DDD) was substantially complete,[1] through the end of 1994, just prior to the January 1995 introduction of "interchangeable" NPA codes.[2] In the three years since the beginning of 1995, the number of operational and assigned area codes in the US has jumped from 118 to 195, and close to half of all Americans will have been or will soon be subject to a change in area code (see Figure 1).[3] Area code introductions are generally of two varieties — *geographic splits* and *all-services overlays*. While both of these devices can offer *temporary* relief for shortages of assignable telephone numbers, neither approach represents a permanent, long term solution and both bring with them serious and costly impacts upon consumers, businesses and the public at large.

Geographic splits. Most of these new area code introductions take the form of a geographic split, in which a previously-defined numbering plan area (NPA) is carved up into two or more non-overlapping regions. When a "split" occurs, a portion of the original

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1. The original North American Numbering Plan was devised by the former Bell System in 1947 with 86 area codes assigned that year. As of 1961, there were 104 NPAs in the United States. Canada had 13 codes, and the Caribbean island countries (including US territories) all shared the single '809' NPA.

2. Prior to 1995, all NANP area codes were required to have a '0' or a '1' as their second digit in order to distinguish them from central office codes that historically were *not* permitted to have either a '0' or a '1' as the second digit. That requirement was eliminated with respect to central office codes in the late 1980s and was eliminated with respect to area codes at the beginning of 1995, making the two types of code fully "interchangeable" with the 'NXX' format of central office codes. Prior to 1995, the theoretical number of 'N0/1X' area codes was 160; after "interchangeable" codes were permitted, that figure increased to 800. In the three years since that occurred, nearly 70 new area codes, or about 11% of the added supply of 640 codes, have already been assigned.

3. Including NANP territories outside the US, between January 1, 1995 and the beginning of 1998, Bellcore has assigned 92 area codes in the new format. (*Area Codes Administration to Move from Bellcore to Lockheed Martin IMS on January 19, 1998*, Bellcore Press Release, January 5, 1998.)

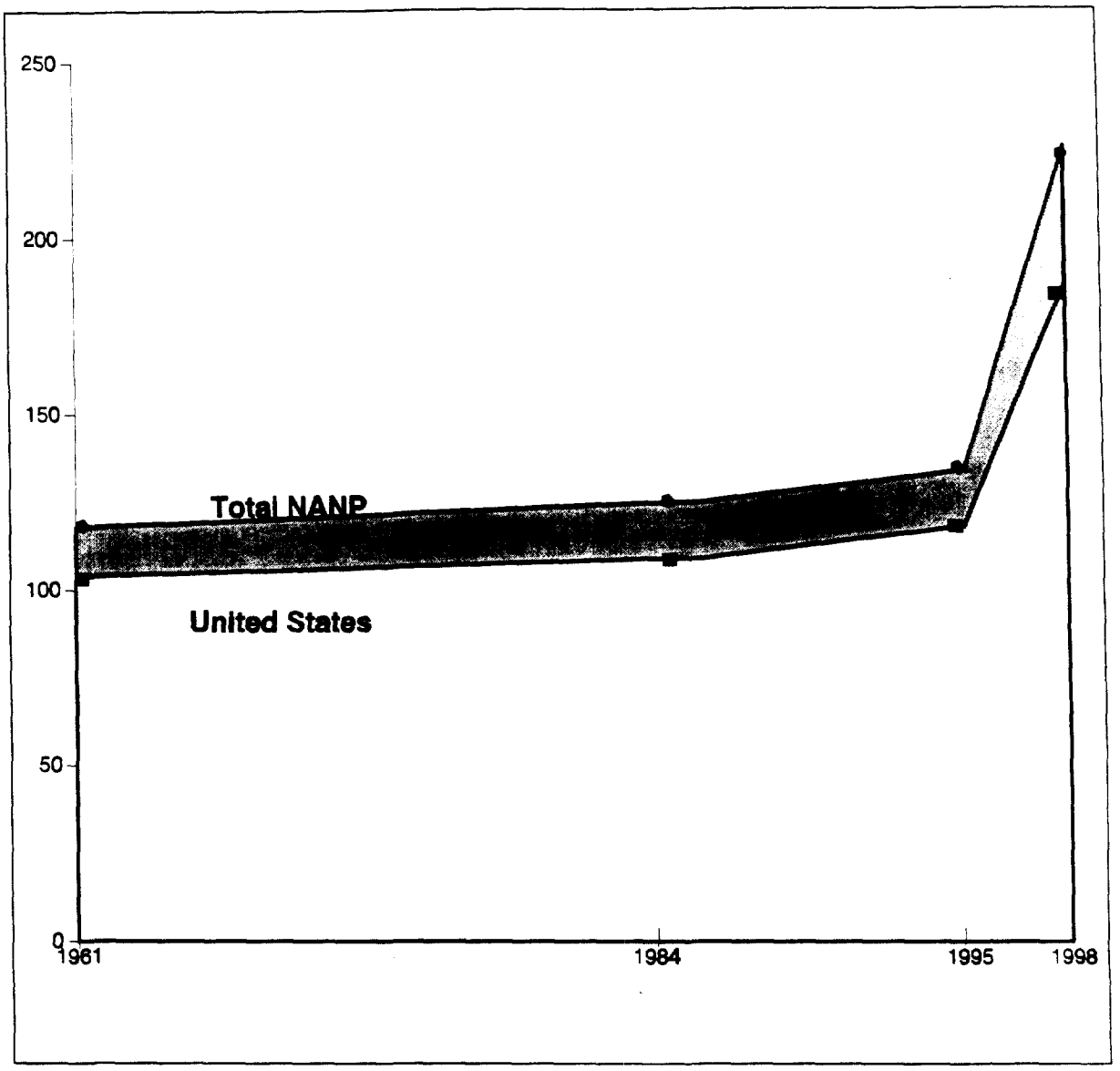

Figure 1. Historical Progression of NANP Area Code Assignments (1961-1998)

NPA (usually the principal population center) retains the preexisting area code, with the remainder being assigned one or more "new" area codes. In a geographic split, most telephone numbers in those portions of the original NPA that are to be assigned a new area code are required to undergo a telephone number change, one that is usually confined to the area code portion of the 10-digit telephone number.[4]

4. As we discuss below, there are exceptions to this "rule." Cellular and certain other wireless telephone numbers have often been exempted from the same type of area code change requirement that is applied to "wireline" subscribers.

Table 1

NANP Area Code Assignments
1961 – 1998

	1961	1984	Dec. 1994 Pre-INPA	Jan. 1998 Post-INPA
US	104	109	118	195
Canada	13	15	15	20
Caribbean	1	1	1	20
TOTAL NANP	118	125	134	235

All-services overlays. A less frequent solution, but one that may gain in acceptance as the pace of area code introductions increases, is a so-called "overlay" of the new area code on top of the same geographic area as the old code. In an "overlay," most or all of the preexisting telephone numbers and central office codes retain the original area code, with all newly created central office codes and associated telephone numbers being assigned to the new area code. In an overlay, customers retain their original 10-digit telephone numbers, but (as a result of a recent FCC order[5]) will be required to dial the area code on *all* calls, *even those to numbers with the same area code as their own.* While this requirement to dial 10 or 11 digits[6] may be inconvenient for most users, the change in dialing pattern imposes particular costs and burdens on users of automatic dialing devices such as burglar/fire alarm systems and some point-of-sale terminals.

Both of these solutions — the geographic split and the overlay — thus have serious shortcomings, particularly for business customers. A forced change in a business telephone number imposes costs to reprint business stationery, signage and advertising materials, and in particular confronts the affected firms with the requirement to aggressively communicate their new telephone number to current as well as to prospective customers or risk future losses of business. The potential impact upon individuals is no less severe. Once the initial "permissive dialing period" (during which the old area code can still be used) has expired, the user's old telephone number is subject to reassignment to a new customer. When such reassignment occurs, a caller to that number would have no immediate means of determining whether the firm's or the individual's phone number had changed, or whether

5. *Second Report and Order and Memorandum Opinion and Order*, FCC 96-333, Adopted August 8, 1996.

6. The prefix digit '1' is usually required for all calls involving an area code. In certain jurisdictions, *local* inter-NPA calls may be dialed on a 10-digit basis, i.e., without the prefix digit '1'.

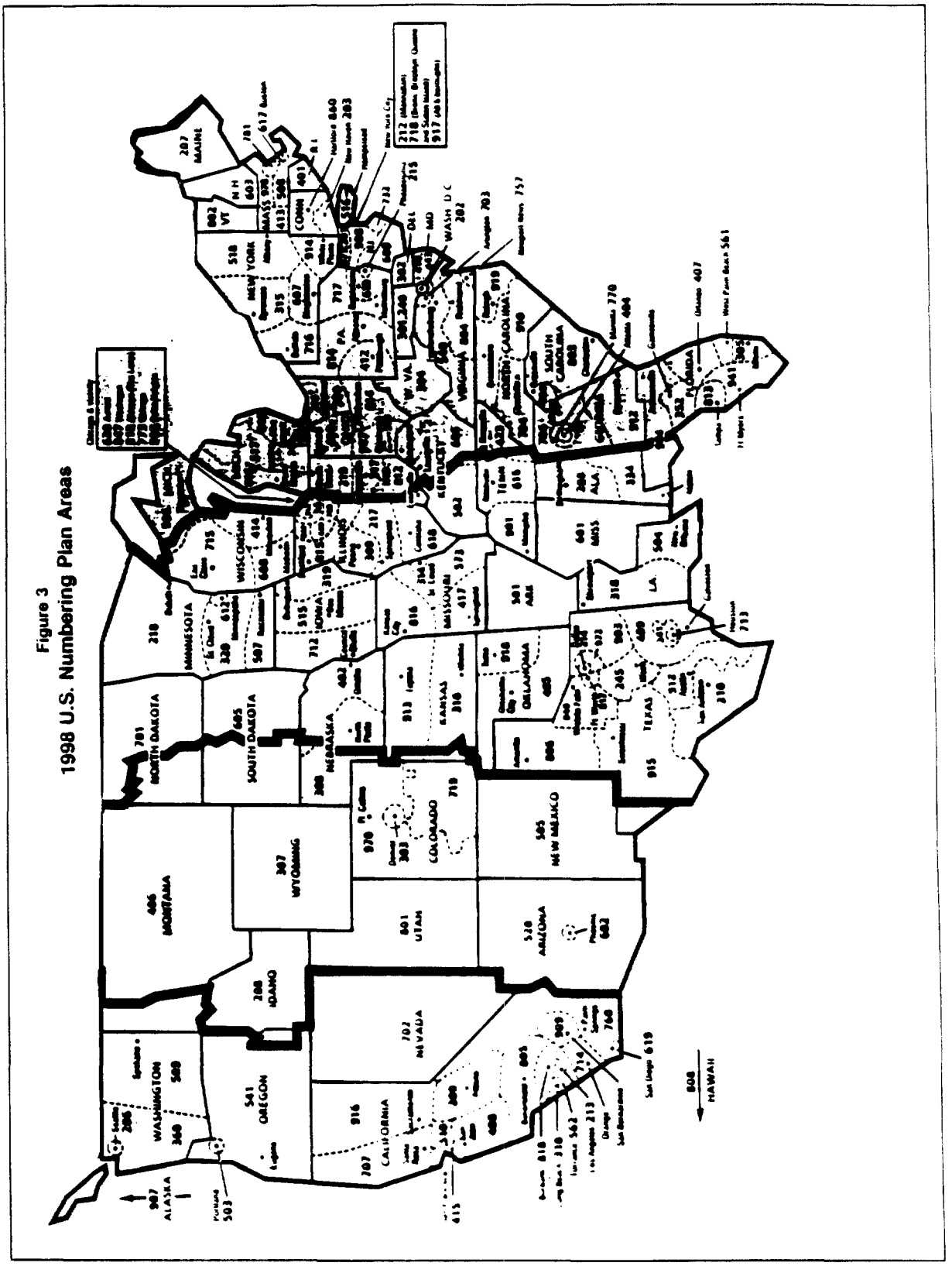

Figure 3
1998 U.S. Numbering Plan Areas

that particular party had simply dropped off the face of the Earth. The impact of such number changes is, of course, compounded as the frequency with which the introduction of new area codes increases, in part due to the growing difficulty on the part of the public at large to keep up with what has now become an all-too-frequent occurrence. In some parts of the country, communities have been confronted with as many as three different numbers within periods of time as short as nine years.[7] In a society where numbers have become almost as important as names, frequent forced number changes are extraordinarily disruptive and those adverse consequences and impacts must not be lightly dismissed.

Ironically, while bearing the lion's share of the costs, burdens and adverse business consequences of area code relief, telephone *users* — small and large, business and residential — have up to now been the most underrepresented stakeholders in state and FCC area code proceedings. The Ad Hoc Telecommunications Users Committee and the International Communications Association believe that state and federal regulators have an obligation to consider the concerns of telephone users and to afford these concerns at least as much weight as is currently being given to the much louder voices of incumbent local exchange carriers and their wireless affiliates. Indeed, as we discuss in the sections that follow, the principal source of the current number exhaust problem lies not in the laps of business or residential consumers or even new local service competitors, but squarely on the ILECs and wireless service providers.

7. In Boston, for example, the 508 area code was split off from the original 617 code in 1988, and the 617/781 and 508/978 splits took place in 1997. Other examples include Los Angeles, where 310 was split from the original 213 area code and then 310 split again with the introduction of the 562 area code in 1996, and Chicago, where 312 was split, first creating the 708 NPA in 1988, followed by the post-1995 introductions of 630, 847, and 773.

2 WHY IS THERE A SHORTAGE OF TELEPHONE NUMBERS?

To be sure, many factors have contributed to the growing demand for, and exhaust of, available telephone numbers. Reports in the popular press frequently blame the growth of modems, fax machines, and cellular phones for the number exhaust problem. However, upon closer analysis, even these seemingly voracious demands for telephone numbers by the ultimate end users do not come even close to accounting for the apparent shortage; the explanation lies in the structure and architecture of the North American Numbering Plan itself, and in the manner in which number resources are assigned and managed.

Fragmentation

The theoretical capacity of each area code is 8-million 7-digit telephone numbers.[8] In practice, certain 3-digit "NXX" codes (roughly 30) in each Numbering Plan Area are considered nonassignable. These include the eight "N11" and eight "N00" codes, along with the specific 3-digit combinations that are also used as the home and adjacent area codes.[9] Also, certain codes are reserved for testing or are excluded from assignment to respect other conventions and uses. Hence, the *effective* capacity of each area code is roughly 7.7-million telephone numbers, more or less. Since there are already some 187 area codes assigned in the United States alone[10] with a combined capacity of nearly 1.5-billion assignable numbers (that's more than five telephone numbers for every adult and child

8. A total of 800 NXX combinations are possible. The first digit ("N") can be between 2 and 9, whereas the second and third digits ("X") can be between 0 and 9.

9. Thus, for example, the combinations '212', '718', '516', '914', '917' and '201' would typically not be assigned as central office codes in the New York City metropolitan area.

10. The North American Numbering Plan area, referred to as World Zone 1, also includes Canada, Bermuda, and 18 telephone company areas in the Caribbean Ocean. (*TACD: Telephone Area Code Directory*, Bellcore Technical Reference, TR-EOP-000093, Issue 12, January 10, 1997, p. 129.)

living in the US today), at first blush it wouldn't seem as if there really is any shortage of numbers at all!

So why does there *appear* to be a drought when we would seem to be awash in a flood of numbers? The answer lies in the extreme *fragmentation* of the numbering resource. With certain limited exceptions,[11] virtually all NANP telephone numbers possess *geographic* attributes. Under the architecture of the North American Numbering Plan, the highest geographic level — the numbering plan area — cover a relatively large territory that in some cases embraces an entire state.[12] The next level is the exchange, followed by the central office. Each of these levels cover progressively smaller geographic areas — with the geographic scope of an individual NXX code usually limited to the area served by a single central office switch. NXX codes that are not assigned within an NPA, or numbers that are not assigned within an individual NXX code, are generally not assignable elsewhere. Thus, where a state (e.g., Wyoming) has a relatively small population such that only 224 out of the roughly 770 possible NXX codes are in use, the remaining 546 NXX codes in that NPA — representing nearly 5.5-million potential telephone numbers — become "stranded" because they are not otherwise assignable. Similarly, if an NXX code is assigned to a central office switch that serves, for example, only 1,000 lines, the remaining 9,000 numbers are also unavailable for assignment in other locations. As the quantity of such geographic units at each NANP level increases and as their relative sizes shrink, the incidence of unusable stranded numbers rises. While there are only 187 NPAs in the US today, there are some 10,000 telephone exchanges containing about 35,000 individual ILEC switching entities, and new CLEC switches are being introduced with growing frequency. Since the assignment of numbers must (under existing practice) be fragmented across these 35,000-plus local switches, the quantity of unusable, stranded numbers has become quite large.

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11. Under the NANP, certain pseudo-area codes, known as Service Access Codes ("SACs") are assigned on a *non-geographic* basis and are used to access several types of public switched network services. For example, the '800' and '888' SACs are used for "toll-free" called-party-pays calls, the '900' SAC is used for "audiotext" and other information services in which the called party (the '900'-service provider) establishes a fee for use of its service, which the originating carrier bills to the calling party and remits to the 900-service sponsor. In the past, all SACs were in the 'N00' format, but with the exhaust of available '800' numbers additional toll-free SACs ('888' and soon '877') had to be established.

12. By convention, the geographic scope of any single area code is limited to one state or Canadian province (with the exception of Nova Scotia and Prince Edward Island, which share the '902' NPA). Moreover, while the '809' NPA had been shared among the US Caribbean territories and 16 island countries from Bermuda to Trinidad, these have now been split into 18 separate NPAs no one of which is shared by two or more countries. Significantly, several of these new Caribbean NPAs contain as few as two NXX codes (see table).

Table 2

Recent Area Code Assignments in the Caribbean Result in Vast Underutilization of Numbering Resources

Island(s)	New NPA	NXX Codes Utilized	NXX Codes Unutilized
Anguilla	264	2	768
Antigua and	268	12	758
Bahamas	242	52	718
Barbados	246	35	735
Bermuda	441	20	750
British Virgin	284	7	763
Cayman Islands	345	7	763
Dominica	767	6	764
Grenada	473	7	763
Jamaica	876	108	662
Montserrat	664	5	765
Puerto Rico	787	365	405
St. Kitts and Nevis	869	5	765
St. Lucia	758	9	761
St.	784	7	763
Trinidad and	868	53	717
Turks and Caicos	649	2	768
U.S. Virgin Islands	340	20	750
TOTAL		**722**	**13,138**

The functions of telephone numbers in the public switched network: Rating and Routing

The basic architecture of the NANP directly supports the two primary functions of telephone numbers in the public switched network — *routing* and *rating*. Calls are *routed* to the central office switch serving the called party on the basis of the area code and (with certain exceptions) the 3-digit NXX code.[13] The last four digits of the telephone number constitute the "logical address" within the switch that identifies the individual customer's telephone line. In the case of geographically fixed services (such as the wireline services offered by local telephone companies), central office 'NXX' codes are typically assigned for call *rating* purposes to "exchanges" each of which is defined administratively as a "rate center" or "rating area" by the service provider. Multiple central office 'NXX' codes may be assigned to the same switch, and one or more switches may be included within the same "exchange." Sometimes a single switching entity serves customers in more than one exchange.[14] When that occurs, it is necessary for rating purposes to assign at least one separate NXX code to that switch for each exchange or rating area that the switch serves. While this basic structure has been in place for more than half a century, this fundamental, albeit latent, defect in the architecture and design of the NANP and the public switched network that it supports was not a major focus of concern until the introduction of new services and the arrival of new carriers became a frequent occurrence.

Unlike wireline services that are geographically *fixed* in place, most wireless services are inherently *mobile* in nature and do not confront the same geographic rating/routing structure that has been created for wireline telephony. However, because wireless (e.g., cellular) switches have been integrated into the public (wireline) switched network, they have, up to now, been required to possess wireline-type rating and routing attributes. The imposition of this requirement on wireless services, coupled with the fundamental architectural limitations of the NANP, has served to exacerbate the overall fragmentation of the nation's numbering resources.

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13. The *Local Exchange Routing Guide* ("*LERG*") is maintained by the Traffic Routing Administration ("TRA") within Bellcore, and provides the correspondence between 6-digit NPA-NXX codes and the physical switching entity in which that code resides. Under certain circumstances, the *LERG* permits routing for a given NPA-NXX to more than one central office switch, although the practice is not widespread at this time. However, as we discuss below, after permanent Local Number Portability ("LNP") has been implemented, this type of routing will become the norm, rather than the exception.

14. This can occur, for example, when two exchanges are physically consolidated into a single central office but which otherwise retain their separate geographic identity for call rating purposes.

"Stranded" telephone numbers and evolving network technology and architecture

The requirement that not less than one full NXX code be assigned for each switch/rating area combination means that many more numbers must be earmarked for exclusive use by specific carriers in specific areas than are actually needed by its customers. A number that is assigned to a carrier but that is not needed to satisfy that carrier's demand becomes "stranded" — i.e., it *will not* be used by the carrier to which it has been assigned, and it *cannot* be made available for use anywhere else or by anyone else. Such "stranded" numbers are, in effect, wasted. If, for example, a particular community with, say, 1,000 residential and business telephones is defined as an "exchange" for rating purposes, then at least one full NXX code must be assigned to that community even though 90% of the 10,000-number capacity of that NXX code will not be used. If the same switch serves, say, five separate communities each one of which has 1,000 telephone numbers and is defined for rating purposes as a unique "exchange," a total of 50,000 telephone numbers will have been reserved for these five "exchanges," 45,000 of which are stranded and not assignable there or anywhere else. This type of condition is not uncommon, and helps to explain why the pace of number assignments and exhaust conditions exceeds actual growth in demand for the underlying services.

Where multiple "exchanges" are served by the same physical switching entity, the *routing* function can be fully satisfied by assigning the same 'NXX' code(s) to the entire group of communities. However, this would not be possible as long as those communities are to be treated for *rating* purposes as separate exchanges. The operative question is, is that really necessary?

The creation of five separate exchanges for the five towns was more than likely an historical artifact rather than something that had been done in fulfillment of any particular purpose. Each of these communities likely was at some point in the past served by its own central office switch; calls between the separate switches involved interoffice transport and may have been (and may still be) treated for rating purposes as toll calls. But dramatic changes both in switching and transport technology over the past decade have produced fundamental and widespread changes in traditional telephone network architectures. Fiber optics and digital carrier systems have all but eliminated *distance* as a significant cost driver which, when coupled with the economies of scale that are present in large digital electronic central office switches, makes it far more efficient to serve multiple small communities out of one relatively large switching entity. Incumbent local telephone companies have been pursuing such "switch consolidations" for a number of years, and the process is still ongoing. For example, Bell Atlantic-Maine's 140 exchanges are presently served by 16 host switches (supported by 125 remotes) and less than a dozen smaller switches.[15] New

15. 1998 LERG (1997 data).

competitive local exchange carriers ("CLECs") are acquiring large-scale switches from which they will serve a geographic area embracing many individual ILEC "exchanges."

The *sole* rationale for retaining extreme granularity in rating areas has been so that *prices* for individual calls could be tied in some manner to *distance*. In so doing, "local" calls could be easily distinguished from "toll" calls, and toll calls could be priced in some relation to the distance involved. While distance may have been an important cost driver in the past, this is no longer the case. Advances in fiber optics and digital electronics have reduced network transport costs by more than three orders-of-magnitude over the past two decades. In fact, the distance-sensitive cost per minute of network transport varies by well under a penny as between the shortest distance calls (such as to an adjacent exchange) and cost-to-coast connections. Prices charged for long distance calls have come to reflect this new cost reality. In 1966, for example, a 3-minute coast-to-coast daytime call was priced at $2.00, some twenty times the $0.10 charge for a three-minute 10-mile interstate daytime call.[16] Long distance carriers including AT&T have been offering pricing plans to their residential and business customers in which distance has been eliminated altogether as a pricing element,[17] and now even under the undiscounted AT&T tariff prices that have been in effect since November 8, 1997, the price ratio for the maximum-to-minimum distance calls has dropped to unity.[18] The proliferation of such distance-insensitive "postalized" pricing plans virtually eliminates the "call rating" function of numbering,[19] and almost certainly eliminates altogether any need to maintain the kind of granularity and fragmentation that presently exists.

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16. Supplemental Testimony and Exhibit of Lee L. Selwyn, California Public Utilities Commission (CPUC), I. 87-11-033, *In the matter of Alternative Regulatory Frameworks for Local Exchange Carriers*, Implementation and Rate Design Phase, April 24, 1992, at 11.

17. See, for example, AT&T's Green Sense Plan (AT&T FCC Tariff No. 27, Page 24-57.35) which offers a postalized $.10 per minute dial station rate with a monthly recurring charge of $4.95.

18. The undiscounted daytime rate for domestic Message Telecommunications Service (MTS) is $0.28 per minute for all rate mileage bands, as of November 8, 1997 ($0.84 for a three-minute daytime call) . Prior to that date, a three-minute 10-mile call was priced at $0.78 versus $0.87 for a three-minute coast-to-coast call. (AT&T Communications, Tariff F.C.C. No. 27, 6th revised Page 24-2, Effective: November 4, 1997.)

19. Rather than being based on distance, rate distinctions today are based primarily upon the *category* of call, e.g., "local," "intraLATA toll," "interLATA intrastate toll," "interstate toll," and "international." The extreme granularity required for a distance-based pricing system becomes unnecessary under current pricing conditions.

New carrier demands for numbers

While the presence of "stranded" (unusable) telephone numbers has, up to now, been primarily confined to relatively small rural and suburban exchanges, the introduction of facilities-based local exchange service competition has brought this condition into urban and larger suburban areas as well. This is because each new carrier will require numbers in each rating area in which it plans to offer service. Where a large number of relatively small individual rating areas are involved, the CLECs' needs for number resources can be massive. Consider, for example, the Boston metropolitan area, where four area codes now occupy a region that had been served by only one as recently as 10 years ago. Figure 4 illustrates the exchange boundary configuration for communities within roughly 12 miles of downtown Boston, an area with a total population of about 3-million.[20] The Boston Metropolitan Exchange Area boundaries and local calling areas were last defined in approximately 1909[21] and include some 47 separate rating areas. Nine of these are located within the City of Boston proper; the remaining 38 serve 53 suburban municipalities.

A CLEC desiring to provide service in the greater Boston area would likely want to have a presence in many, perhaps even all, of these communities. Initially, at least, all would likely be served out of the same CLEC switching facility. Under existing number assignment practices and policies, each CLEC desiring to serve all of the Metropolitan Boston exchanges would require no less than 47 distinct NXX codes, representing a potential capacity of close to one-half million 7-digit telephone numbers. If we extend the scope of the metropolitan area beyond the 12 mile limit that was defined nearly a century ago, the quantity of rating areas grows exponentially. For example, there are 81 rating areas within a 20-mile radius of downtown Boston, and well over 150 in the nine eastern Massachusetts counties whose total population is approximately 4.5 million. Multiply those quantities of exchanges by 10,000 numbers per NXX code, and multiply that product by however many CLECs choose to enter the market (there are currently nine certificated facilities-based CLECs building out networks in the Boston area), and it is easy to see how quickly numbers will become committed and non-assignable for other purposes.

This is not just a Boston problem; it is happening across the country, and will become even more acute as the number and market coverage of CLECs proliferates. Figure 5 illustrates the corresponding situation in the Chicago metropolitan area, where demands for new NXX codes have mushroomed over the past decade. Prior to July 1988, all of Eastern Massachusetts was included within the '617' NPA; today there are four area codes serving

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20. The Rand McNally 1994 Commercial Atlas and Marketing Guide (125th Edition) reports an estimated 1992 Boston Primary Metropolitan Statistical Area (PMSA) population of 3,216,800.

21. Direct Testimony and Exhibit of Lee L. Selwyn, *Investigation by the Department on its own motion as to the propriety of the rates and charges filed by the New England Telephone and Telegraph Company on October 1 1980*, Mass. DPU 411, December 15, 1980, at 199.

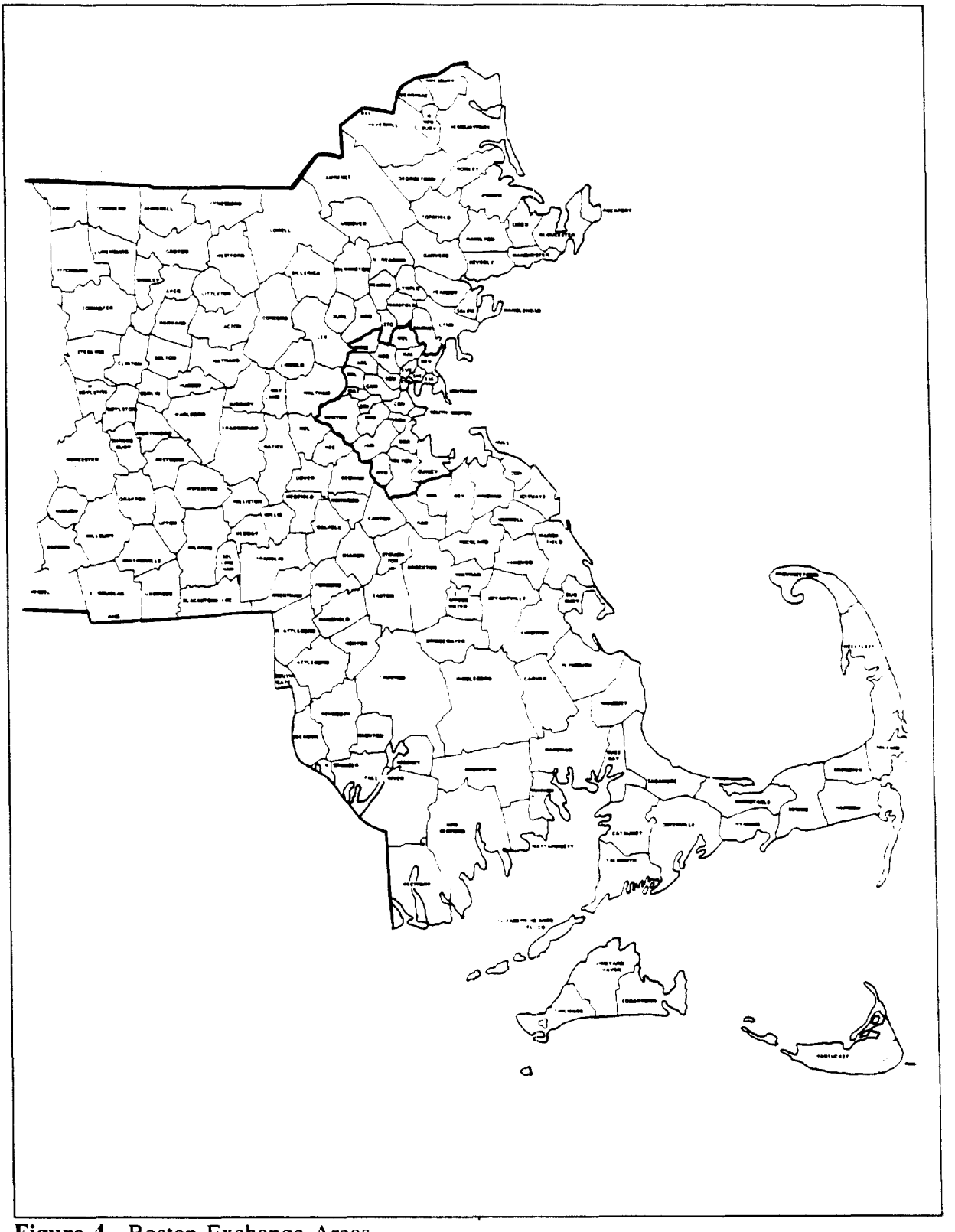

Figure 4. Boston Exchange Areas

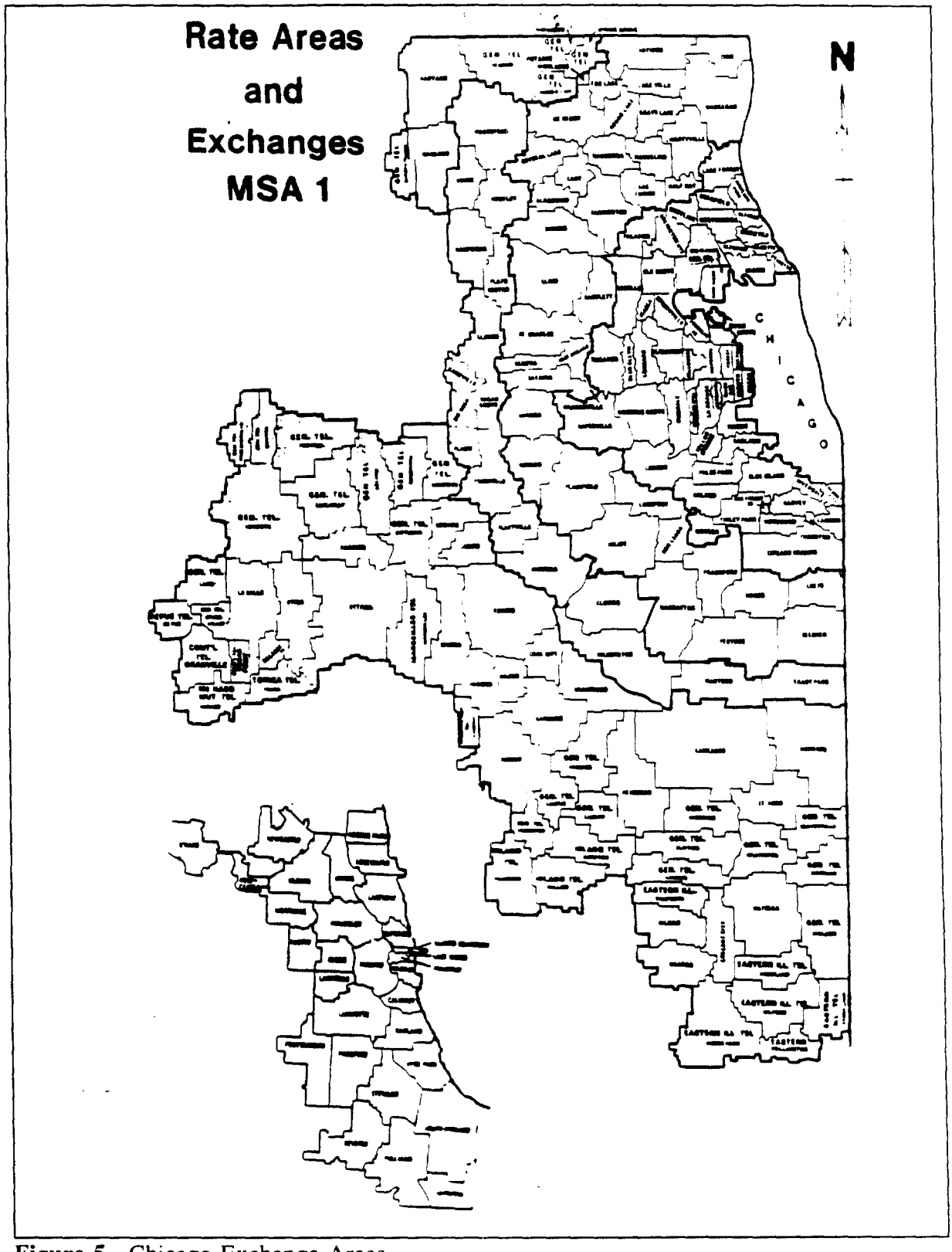

Figure 5. Chicago Exchange Areas

that same geographic area. Prior to November 1989, the entire Chicago metropolitan area was included within the'312' NPA; today the region has been carved up into five area codes, and Ameritech projects that this number could double within the next several years. Los Angeles County, once constituting the '213' NPA, is now served by six area codes. In fact, there are today 23 area codes (operational and assigned) in all of California, more than double the 10 codes extant at the 1984 break-up of the former Bell System. Within the next four years, California is expected to reach a total of 26 area codes.[22] The following table demonstrates the pervasiveness of NPA growth from 1961 to 1998 all across the country.

There is no shortage of telephone numbers

While the various sources of demand for NXX codes identified here — fragmentation and associated "stranding" of unused numbers and NXX codes, growth of new carriers and services, and extreme granularity in the geographic definition of local rating areas — are the primary causes of NPA exhaust, national number resources management policies have up to now focused almost exclusively upon creating additional *supply* of numbers rather than upon addressing and more effectively managing the sources of *demand*. In effect, those responsible for number resources management have been operating *as if* the supply of numbers is limitless and the creation of additional supply is costless. As we demonstrate below, these assumptions — and particularly the second one — are patently false. Effective number resource management must address number demand and implement processes and practices that reduce and eliminate altogether the need to create new NPAs. In the following sections of this report, we demonstrate that such measures are technically feasible, effective in limiting the need to constantly create new number supply, and are clearly and unambiguously in the public interest.

22. *And the New Number is ... 831: Plan Filed to Split 408 Area Code*, Online News Release from Pacific Telesis, January 15, 1997.

Table 3

NANP Area Codes Assigned in the United States (1961-1998)

State	1961	1984	Dec. 1994 Pre-INPA	Jan. 1998 Post-INPA	State	1961	1984	Dec. 1994 Pre-INPA	Jan. 1998 Post-INPA
AL	1	1	1	3	MT	1	1	1	1
AK	1	1	1	1	NE	2	2	2	2
AZ	1	1	1	2	NV	1	1	1	1
AR	1	1	1	2	NH	1	1	1	1
CA	8	10	11	23	NJ	2	2	3	5
CO	1	1	1	4	NM	1	1	1	1
CT	1	1	1	2	NY	7	7	7	9
DE	1	1	1	1	NC	2	2	3	6
DC	1	1	1	1	ND	1	1	1	1
FL	2	3	4	10	OH	4	4	4	8
GA	2	2	2	5	OK	2	2	2	3
HI	1	1	1	1	OR	1	1	1	2
ID	1	1	1	1	PA	4	4	4	6
IL	5	5	6	9	RI	1	1	1	1
IN	3	3	3	4	SC	1	1	1	3
IA	3	3	3	3	SD	1	1	1	1
KS	2	2	2	3	TN	2	2	2	4
KY	2	2	2	2	TX	6	7	8	15
LA	2	2	2	2	UT	1	1	1	2
ME	1	1	1	1	VT	1	1	1	1
MD	1	1	2	4	VA	1	2	2	4
MA	2	2	3	5	WA	2	2	2	5
MI	4	4	5	7	WV	1	1	1	1
MN	3	3	3	4	WI	3	3	3	4
MS	1	1	1	2	WY	1	1	1	1
MO	3	3	3	5	**TOTAL**	**104**	**109**	**118**	**195**

3 | ASSESSING AND MINIMIZING THE COSTS OF NUMBER EXHAUST SOLUTIONS

Up to now, the telephone industry's solution to the "shortage" of telephone numbers has been simply to create new ones. This "brute force" approach — like buying a new car that comes with a full tank of gas each time the tank in the old one is empty — is costly to all concerned and serves only to defer, rather than to *solve*, the number exhaust problem. Since January 1995, roughly one-half billion "new" telephone numbers have been or will soon be created out of thin air using this technique.[23] But creating new telephone numbers is neither easy nor inexpensive. Implementation of an area code split involves complex "programming" of routing and translation tables and data bases in central office switches both within the affected area as well as throughout the NANP. Incumbent LECs have estimated their costs for implementing an area code split at around $3-million each.[24] Extrapolating this amount to the 69 new US area codes that have been or that are now being cut into service since 1995, US telcos will have spent in the range of $210-million on what are at best stop-gap measures. Additional costs are also imposed upon other local, long distance and wireless carriers in the affected area and elsewhere, because call routing and rating tables must be revised in local and toll switches throughout the public network.[25]

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23. Between January 1995 and December 1997, a total of 69 new area codes were placed in service or were assigned and in the process of being implemented in the US alone. Each new code represents roughly 7.7-million "new" telephone numbers.

24. Illinois Bell included in its annual rate filing an exogenous change or "Z" factor, to recover the LNPA expenses (approximately $6 million) associated with two area code splits in the Chicago area. (Illinois Bell Telephone Company, Annual Rate Filing for Noncompetitive Services Under an Alternative Form of Regulation Hearing Examiner Proposed Order, Docket No. 96-0172, May 24, 1996, p. 2.)

25. Cellular carriers face the additional costs and effort to reprogram customers' cellular phones with the new area code, a condition that has prompted many to seek and to obtain "grandfathering" status, effectively exempting them from the kind of number changes that are forced upon all other users. As we discuss below, these exemptions have worked to exacerbate the overall number exhaust problem, and have merely shifted costs from the cellular carriers to nearly everyone else.

The broad societal costs of area code "relief" are rarely considered

These direct telephone industry costs and impacts are, however, only the tip of the iceberg. Regrettably, most regulatory decisions affecting area codes and number relief have largely ignored or lightly dismissed costs incurred and impacts suffered by *users* of the public telephone network. And these costs are anything but insignificant.

- Businesses are required to reprint stationery, signage, and advertising materials, and may often feel compelled to initiate costly mailings to their customers informing them of the number change.

- Because telephone numbers — and area codes in particular — convey geographic information, an area code split can result in the loss of a community's geographic identity. For example, when the major population center and its suburbs share the same area code, the proximate location of, for example, a suburban business with its principal city can be readily identified. When that suburban community is placed in a different area code — and as the total number of area codes increases overall — the geographic linkage is broken. In such cases, some businesses may feel compelled for business reasons to order foreign exchange and/or remote call forwarding service so as to retain their "local presence" in the geographic markets in which they operate.

- Businesses also risk permanent loss of customers when a caller using the "old" number is no longer directed (via an intercept) to the "new" number or, worse, reaches the party to whom the "old" number has now been reassigned. Unless the customer makes a special effort to locate the correct number, the loss of business will be permanent.

- Alarm monitoring companies are required to reprogram dialing devices located on their patrons' premises, a costly task that often requires site visits by a technician to each affected customer. Reprogramming may be required both under a geographic split (where the patron and the central station are assigned to different NPAs) or under a general overlay (where a change from 7- to 10-/11-digit dialing is required for all calls). Moreover, the failure of an alarm service provider to complete this task within the time frame allowed under the "permissive" dialing period can result in alarms not being correctly routed and emergency assistance not being provided.

- Business PBX users may be required to incur reprogramming fees to accommodate new area codes in toll restriction and route selection tables. They may also be required to purchase additional hardware and, in some cases, must actually replace older systems that cannot accommodate the additional codes or new dialing protocols.

- Government agencies, and in particular those charged with public safety responsibility, may be required to advertise number changes or otherwise communicate with citizens to advise them of new dialing requirements. Once the permissive dialing period ends, difficulties encountered in reaching an agency or bureau may engender other costs and public safety risks.

- Users of point-of-sale terminals and other devices that automatically dial pre-programmed telephone numbers will be required to individually reprogram some units.

- Customer (in the case of businesses) and citizen (in the case of government agencies) data bases must be revised to reflect the changed telephone numbers. In many cases, these revisions must be done individually and manually, particularly if the revision does not take place *en masse* at the moment of the area code split. This problem is particularly costly where multiple area code changes affecting the same area have taken place, and/or where the nature of the customer/citizen data base would not ordinarily involve frequent interaction with the individual subjects.[26]

The enormity of these costs has never been quantified, but the lack of a specific dollar figure does not diminish their overall magnitude. Consider, for example, the matter of revising data bases. Assuming (conservatively) that, on average, about one million residential telephone numbers are changed each time an area code is split, then since 1995 nearly 70-million, or about 65%, of all residential telephone numbers have been or will shortly be subject to an area code change. Assuming, conservatively, that the average household appears in ten commercial or government data bases and that the cost of manually revising each such entry is $2, more than $1.4-billion will have been spent on this one activity alone.

The burglar/fire alarm industry currently serves some 23.8-million residential and business premises.[27] Extrapolating the same 65% number change figure to this market, some 15-million alarm systems will require reprogramming to accommodate the new area code. The use of overlays instead of splits, incidentally, actually exacerbates, rather than minimizes, the reprogramming problem for alarm companies because all calls to the alarm monitoring central station — even where the subscriber and the central station have the same area code — will now require 10- or 11-digit dialing. In most cases, reprogramming

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26. Companies that perform marketing research offer a case in point. A recent article in *The Wall Street Journal* (January 22, 1998, p. 1) notes that the proliferation of area codes increases the risk of flawed research. It further reports that Survey Sampling, Inc. warns its clients that the fast pace of area code changes means telephone lists have a shorter shelf life and that "[s]tudies won't represent an entire market if area codes are missed and old numbers are treated as nonworking telephones."

27. *The 1996 Security Sales Dealer Survey*, compiled by Advantage Business Research, Inc., reports a Total Installed Population, 1996 estimate, of 23.8 million (citing data compiled by STAT Resources, Inc.).

of the dialing units requires a premises visit by an alarm company technician. Assuming, conservatively, a cost of $50 for each such visit, alarm service providers and their subscribers will have expended some $750-million to accommodate the "stop-gap" solution of creating new area codes that the telephone industry persists in pursuing. And this cost does not include the societal costs, in terms of loss of life and property, of alarms that are not correctly routed because the reprogramming had not been completed within the allowed period of time.

It is almost impossible to quantify the costs that are incurred by businesses in communicating their own telephone number changes to their present and potential customers. Reprinting stationery and signage is obviously required, but companies that are concerned about the potential for a permanent loss of business may feel compelled to adopt various affirmative means for communicating their new phone numbers to customers.[28] This might involve things like special mailings and additional advertising, all of which create costs that may be substantial.

Loss of geographic identity

Most geographic split plans have attempted to minimize the overall business user impact by allowing the principal business center of the preexisting NPA (e.g., the Chicago "Loop," downtown Boston, center city Philadelphia, downtown Los Angeles, Manhattan, Miami, Cleveland, San Francisco, Seattle) to retain the "old" area code, subjecting suburban areas and smaller cities to an area code change. The effect of this "solution" is to spread the costs and burdens disproportionately (and, some would argue, unfairly) to businesses and residents outside of the principal population center, rather than to pursue a more efficient, permanent overall approach.

Indeed, because of this policy of "protecting" the principal population center, customers in other areas have in some cases been subjected to a succession of area code changes as the new NPAs themselves reached exhaust. For example, a number of suburban communities northwest of Chicago may soon experience their *third* area code change (i.e., their

28. It is noteworthy that ILECs do not even attempt to time the distribution of new telephone directories with the cutover date for a new area code. In August and September, 1997, Bell Atlantic distributed new directories in a number of suburban Boston communities *whose numbers were going to be affected by two area code splits that were, as of that time, slated to become effective on January 1, 1998.* Not only did these books fail to reflect the new telephone numbers, they actually made no mention of the (then impending) split at all! Since, under the normal publication cycle for these books, new directories will not be published again until August or September of *1998*, subscribers in the affected communities will continue to have incorrect telephone numbers printed in their local white and yellow pages directories for as long as seven months following the termination of permissive dialing.

fourth different area code) within a ten-year period.[29] And numerous communities in the Los Angeles, Boston, Miami/South Florida, and northern New Jersey areas have already been shifted into their third area code in less than a decade while the prime downtown business centers have escaped all of these number changes.

In fact, the precise location of the new NPA boundary is almost always highly controversial precisely because of the strong geographic identity that the public attaches to an area code. Telephone numbers convey geographic information about the communities to which they are assigned. Area codes, in particular, are frequently recognized with the city or state to which each applies, and as the number of area codes proliferates, the retention of such geographic identification becomes more difficult. Moreover, since central office serving areas rarely correspond with recognized political boundaries, communities are sometimes divided between the newly-created NPAs. When that occurs, it may be necessary for calls placed across the boundary to be dialed on a 10- or 11-digit basis, and the municipality will no longer possess a unique area code identity when called from outside of the local area.[30]

It should be noted that strict adherence to ILEC serving area boundaries may also impose competitive disadvantages upon CLECs. For example, will CLECs in a municipality that is divided between two NPAs be required to respect the NPA boundary that was drawn based upon the *ILEC's* central office and outside plant deployment? If so, the CLEC may require more NXX codes than would otherwise be necessary, and would almost certainly confront administrative costs and burdens. On the other hand, if the CLEC uses the same NPA-NXX to serve its customers throughout the municipality irrespective of their specific location, in some cases CLEC customers would be assigned different area codes than their next-door neighbor who continues to take service from the incumbent.

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29. ICC No. 97-0211, *Illinois Bell Telephone Company Petition for Approval of an NPA Relief Plan for the 847 NPA*, May 5, 1997.

30. Area code boundaries, when first drawn in the late 1940s, respected state and (in the case of Canada) provincial boundaries, and in many cases respected county or other political subdivision boundaries within a state. *This was true even though specific central offices sometimes served customers on both sides of a state line or other area code boundary.* Early area code splits attempted, where possible, to respect this objective, but some of the more recent ones have not. For example, when the 212 New York City NPA was split in the mid-1980s, the boundary (at that time) was the East River (Manhattan and the Bronx remained in 212, while Brooklyn, Queens and Staten Island were shifted to 718). And, as a result of good planning, it became possible for New York Telephone to shift the Bronx out of 212 and into 718 without implementing an additional New York City geographic NPA when the 212 area needed relief in 1991. Similarly, when Ameritech determined to remove the Chicago suburbs from the 312 NPA in 1989, it set the 312/708 NPA boundary at the Chicago City Limits. However, the boundary line created by Ameritech for the 1997 216/440 split in the Cleveland area bisected some 13 municipalities, prompting several to pursue legal action to stop or modify the Company's plan. At a minimum, when an area code must be split, the new boundary should, where feasible, be drawn so as to coincide, to the greatest possible extent, with easily recognizable lines of demarcation.

The ILECs' efforts to draw the new NPA boundaries so as to protect the principal business centers from number changes is just about the only evidence that the incumbent local telephone companies (who have inherited primary responsibility for local number administration) recognize that their "solution" (i.e., creation of additional area codes) imposes costs outside of the telephone industry itself. But that is as far as they have been willing to go to mitigate non-industry costs and burdens. Neither the number administrators, the carriers to whom numbers are assigned, nor the FCC and many state regulators, have demonstrated any serious effort to pursue numbering policies that minimize *societal* costs. Yet it is that specific objective that should be the primary focus of all such efforts.